UNIVERSITI PUTRA MALAYSIA

COST STRUCTURE OF CONVENTIONAL STEAM HEATED TIMBER KILN DRYING INDUSTRY IN MALAYSIA

A. SINGARAM A/L AYERU

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By

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Thesis Submitted to the Graduate School, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

February 2002

Dedicated to
my wife, Puvaneswary,
my daughter, Anusha
and son, Thineswar.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the Degree of Master of Science

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Chairman : Assoc. Prof. Dr. Mohd Hamami Sahri
Faculty : Forestry

Steam heated kiln drying is one the of the method used for drying timber. This activity involves the establishment of kiln plants which requires large capital investment. The economics of kiln drying operation is important in order to determine the optimal level of timber to be dried. This can be estimated through understanding the cost structure and cost function of the industry. A study was conducted to estimate the cost structure of steam-heated wood drying activities.

Data on cost and other associated information on production of kiln drying activities as well as background information of the firm were collected through personal interview. A structured questionnaire was used to collect information

required in the study. A total of 104 kiln plants, which are currently operated in Malaysia, were interviewed. Data were analysed to obtain the average cost of drying timber and statistical analysis was carried out to test the mean differences between plants size. An empirical analysis was conducted to estimate the cost function of the industry.

The survey found that most of the respondents (91 percent) have a treatment unit in addition to their kiln drying activity. About 60 percent of the respondents use their facilities to dry outside timber as service providers. The majority of them (82 percent) are involved in drying Rubberwood. Brick-made kiln chamber is very common among the surveyed plants, with 65 percent of them using it. The major drying defects encountered by the kiln drying industry is uneven moisture content distribution among the timber dried. About 60 percent of respondent employ certified kiln operator.

The average cost of drying timber is estimated at RM 73 per cubic metre. Interest paid for the capital loan dominated the cost structure; accounts for 28.96 percent of the total drying cost (RM 21.05 per cubic metre). This is followed by energy expenses with the average cost of RM 17.19 per cubic metre (24 percent). Other cost components include stacking (RM 7.51 per cubic metre), drying defect (RM 11.89), overhead (RM 7.08) and depreciation (RM 4.62). Other components are also important such as maintenance cost, interest on timber inventory and insurance premium, which accounts for 1.84 percent (RM 1.34), 1.14 percent (RM

0.83) and 1.61 percent (RM1.17) respectively.

The t-test shows that the means of the cost components of interest on inventory interest on capital, overhead, depreciation, maintenance and insurance are significantly different between the large and the smaller plants at 5 percent level. The average cost of drying timber for large plants is RM 79.17 per cubic metre compared to RM 64.49 for small plants. The mean of the energy cost, stacking and defect cost components are not significantly significant between the two size of plants.

The industry is characterised by the normal U-shaped cost curve. The total cost function for the kiln drying industry shows quadratic function and the cost function estimated using the Weighted Least Square (WLS) is :

$$TC = 773665 - 59.881\ Q + 0.00457\ Q^2 .$$

The minimum efficient output level of the industry is 13,555 cubic metres. The estimated cost elasticity is 1.48, indicating that the industry exhibits diseconomies of scale.

Although the kiln drying industry faces a number of problems, this survey found that high electricity cost is the main complaint. This and other cost elements have caused their overall operation costs to be higher.

Based on the study, it is recommended that the optimal level of the kiln capacity for this industry should be considered by the firm before setting up a new kiln dry plant or to expand the capacity of the existing plant. Some of the larger plants that are currently in operation need to reduce their output to achieve the economies of scale. Optimising the kiln capacity is important in order to obtain maximum profit in the long run.

Abstrak tesis yang dikemukakam kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

STRUKTUR KOS INDUSTRI PENGERINGAN KAYU SECARA PEMANASAN STEAM DI MALAYSIA

Oleh

A. SINGARAM A/L AYERU

Februari 2002

Pengerusi : Prof. Madya Dr. Mohd Hamami Sahri
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Pengeringan tanur secara pemanasan stim merupakan salah satu kaedah untuk mengeringkan kayu. Aktiviti ini melibatkan penubuhan kilang yang memerlukan pelaburan kapital yang tinggi. Aspek mengenai ekonomi operasi pengeringan tanur adalah mustahak bagi menentukkan tahap optimum jumlah kayu untuk dikeringkan. Ini boleh dianggarkan melalui pemahaman mengenai struktur kos industri. Satu kajian telah dijalankan untuk menganggarkan struktur kos bagi aktiviti pengeringan kayu secara pemanasan stim.

Data mengenai kos dan lain-lain maklumat yang berkaitan dengan pengeluaran aktiviti pengeringan kayu serta maklumat latar belakang kilang

dikumpulkan melalui temubual persendirian. Satu borang soal selidik berstruktur digunakan untuk mengumpulkan maklumat yang dikehendaki untuk kajian ini. Sejumlah 104 kilang yang beroperasi di Malaysia telah ditemuduga. Data-data telah dianalisis untuk mendapatkan kos purata bagi mengeringkan kayu dan analisis statistik telah dijalankan untuk menguji perbezaan min. Analisis empirikal dibuat untuk menganggarkan formula kos industri ini.

Kajian ini mendapati kebanyakkan (91 peratus) responden mempunyai logi pengawetan kayu di samping menjalankan aktiviti pengeringan kayu. Adalah didapati 60 peratus daripada responden menggunakan kemudahan mereka untuk mengeringkan kayu luar iaitu sebagai pemberi kemudahan. Kebanyakkan daripada mereka (82 peratus) terlibat dalam pengeringan Kayu Getah. Tanor yang diperbuat daripada batu-bata adalah luas digunakan di kalangan kilang-kilang yang dikaji, di mana 65 peratus kilang yang dikaji menggunakan kaedah ini. Kecacatan pengeringan utama yang dialami oleh industri pengeringan kayu adalah taburan kandungan lembapan yang tidak sekata antara kepingan kayu-kayu yang dikeringkan. Sebanyak 60 peratus responden mempunyai operator tanor yang berkelayakan.

Kos purata untuk mengering kayu adalah dianggarkan sebanyak RM 73 se meter padu. Elemen faedah yang dibayar ke atas pinjaman kapital merupakan kos utama dalam struktur kos ini di mana ianya mewakili sebanyak 28.96 peratus daripada jumlah keseluruhan kos pengeringan (RM 21.05 se meter padu). Kos-kos

lain termasuklah penyusunan kayu (RM 7.51 se meter padu), kecacatan kayu (RM 11.89), overhead (RM 7.08) dan susut nilai (RM 4.62). Komponen-komponen lain adalah juga penting seperti kos baik pulih, faedah ke atas inventori serta premium insuran yang mana masing-masing adalah sebanyak 1.84 peratus (RM 1.34), 1.14 peratus (RM 0.83), dan 1.61 peratus (RM 1.17).

Ujian t menunjukkan min bagi komponen kos faedah keatas inventori, faedah kapital, overhead, susut nilai, baik pulih dan insuran mempunyai perbezaan yang bererti antara kilang-kilang besar and kecil pada paras keertian 5 peratus. Purata kos untuk pengeringan kayu untuk kilang besar adalah RM 79.17 se meter padu berbanding dengan RM 64.49 untuk kilang kecil. Purata kos bagi komponen bahanapi, penyusunan kayu dan kecacatan kayu adalah tidak mempunyai perbezaan bererti antara saiz kilang.

Industri ini mempunyai ciri lengkok kos berbentuk-U yang lazim. Fungsi kos untuk industri pengeringan kayu menunjukkan fungsi quadratik dan fungsi kos yang dianggarkan melalui kaedah Kuasa Dua Berwajaran (WLS) adalah:

$$TC = 773665 - 59.881Q + 0.00457 Q^2 .$$

Tahap minimum keluaran yang cekap bagi industri ini adalah 13,555 meter padu setahun. Anggaran anjalan kos adalah 1.48, menunjukkan bahawa industri memperlihatkan skala tidak berekonomik.

Walaupun industri pengeringan tanor menghadapi beberapa masalah, kajian ini mendapati kos elektrik yang tinggi merupakan aduan utama. Kos yang tinggi ini, beserta elemen kos yang lain menyebabkan peningkatan dalam kos operasi.

Berdasarkan kajian ini, adalah disyorkam bahawa tahap optimum kapasiti keluaran bagi industri ini perlulah dipertimbangkan sebelum menubuhkan kilang pengeringan baru atau jika hendak menambah kapasiti kilang yang sedia ada. Beberapa kilang besar yang beroperasi sekarang perlulah mengurangkan keluaran mereka untuk mencapai skala ekonomik. Kapasiti tanur yang optimum perlulah dicapai untuk mendapatkan keuntungan yang maksimum dalam jangka masa panjang.

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I certify that an Examination Commitee met on 4th February 2002 to conduct the final examination of A.Singaram a/l Ayeru on his Master of Science thesis entitled "Cost Structure of Conventional Steam Heated Timber Kiln Drying Industry in Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulation 1981. The Commitee recommends that the candidate be awarded the relevant degree. Members for the Examination Committee are as follows :

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This thesis submitted to the Senate of Universiti Putra Malaysia has been accepted as fulfilment of the requirement for the degree of Master of Science.

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

(A. SINGARAM A/L AYERU),

Date: 18/2/2002

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LIST OF ABBREVIATIONS

ASEAN	Association of South East Asia Nations
ATTC	ASEAN Timber Technology Centre
FRIM	Forest Research Institute of Malaysia
ha	Hectare
KD	Kiln drying
mc	Moisture content
m^3	Cubic metre
MITI	Ministry of International Trade and Industry
MTIB	The Malaysian Timber Industry Board
MGR	Malaysian Grading Rules
OLS	Ordinary Least Square
RM	Ringgit Malaysia
SIRIM	Standards and Industries Research Institute of Malaysia
UK	United Kingdom
USA	United States of America
USD	United States Dollar
UPM	Universiti Putra Malaysia
WLS	Weighted Least Square

CHAPTER I

INTRODUCTION

General Background

The timber kiln drying industry in Malaysia was established in the 1960's. By 1970's about 20 plants were set up throughout the country. The state of Selangor was a favourable location due to the fact it was well developed with infrastructure facilities such as roads, business premises, financial services and port (Port Kelang) (Rajan *et al.*, 1989). These favourable factors coupled with the concentration of sawmills have encouraged more kiln drying plants to be established in this state. Other states that have port facilities like Selangor, such as Pahang, Penang and Johor have also managed to attract establishment of the kiln drying plants compared to states which lack shipping facilities.

During the earlier days, timber was kiln dried only for the export market. Most of the kiln drying plants were located strategically in the port area. These plants provided drying services to timber exporters. These kiln plants normally have big individual kiln chambers, sometime up to 280 m^3 capacities. The strategic location of the costume service kiln at the ports have been providing the timber exporter with better management facilities such as :

- centralising the in-coming of timber from various sawmills.
- storage facilities for timber before and after kiln drying.
- easier quality control inspection when necessary
- ability to meet shipping schedule
- minimising transport cost
- availability of jetties facilities the loading of timber into ships.

The emergence of Rubberwood in the 1970's saw more kiln drying plants being established in the rubber rich areas in Kedah/Penang and Malacca/Negeri Sembilan regions (Choo *et al.*, 1989). This 'new' timber is very prone to insect and sapstain (blue stain) fungal attack (Hong *et al.*, 1980). One of the recommended methods to control the sapstain attacks is to kiln dry the timber immediately (Anon, 1971). Therefore, the setting up of the kiln plants at these areas is crucial to maintain the quality of Rubberwood.

In the 1990's, the Government started to emphasise and encourage the export of value added products especially furniture. In order to achieve these objectives, the government has also instituted certain policies directed towards discouraging the export of primary processed products. Most furniture importers require that the products they import be dried to suit the condition of service in the country of destination (Vernon, 1989). This requirement has encouraged the establishment of more kiln dry plants in other parts of Malaysia. With the concern

of the quality and the transportation cost, more down-stream processing companies established their own kiln drying facilities. In Muar district, Johor for instance, which can be considered as the world's biggest Rubberwood furniture manufacturing region, there are more than 5 furniture plants having their own drying facilities. In addition, the government under the Industrial Master Plan (IMP) will assist in establishing kiln drying plants to enhance the role of the government to establish furniture parks (Anon, 1996a). Currently, there are over 300 kiln drying plants operating in Malaysia. The distribution of the kiln dry plants in Malaysia is listed in the Table 1. Currently Sabah has the most number of mills because of high volume of sawntimber export.

Table 1 : Distribution of the Kiln Drying Plants in Malaysia - 1998

State	No. Of Kiln Drying Plants	Percentage
1. Sabah	88	28.79
2. Sarawak	47	15.36
3. Selangor	45	14.71
4. Johor	23	7.51
5. Pahang	21	6.85
6. Kedah	15	4.90
7. Perak	12	3.92
8. Kuala Lumpur	11	3.59
9. N. Sembilan	11	3.59
10. Penang	10	3.27
11. Melaka	8	2.61
13. Terengganu	8	2.61
14. Kelantan	7	2.29
Total	306	100

Source : The Malaysian Timber Industry Board

The direct contribution of the kiln drying industry towards our national economy can be seen from the fact that about 40 percent of all sawn timber exported from Peninsular Malaysia in 2000 were kiln dried. The trend of kiln dried sawntimber export over the last 10 years is given in Table 2. Although the volume of sawn timber exported decreases over the years, the percentage of kiln dried timber over the total sawntimber export shows an increasing trend. In 1990, a total of 3 million m^3 of sawntimber was exported, of which 21 percent (619,425 m^3) were kiln dried. While in 2000, the total volume reduced to 944,224 m^3 and the kiln dried material were 40 percent (375,133 m^3) . In terms of employment, it is estimated that about 10,000 people were employed by this sub-sector in 2000.

Table 2 : Export of Kiln Dried Timber From Peninsular Malaysia (1990 - 2000)

Year	Total Sawntimber Exported (m^3)	Kiln Dried Timber (m^3)	Percentage of Kiln Dried
1990	2,996,380	619,425	21 %
1991	2,230,607	298,648	22 %
1992	2,195,336	504,967	23 %
1993	2,038,054	429,402	21 %
1994	1,462,561	344,626	24 %
1995	1,337,024	343,488	25 %
1996	1,189,781	368,835	31 %
1997	893,252	332,442	37 %
1998	828,750	361,658	43 %
1999	973,808	350,957	36 %
2000	944,224	375,133	40%

Source : Maskayu (various issues)

In addition, the kiln drying is also an important and necessary intermediary process to prepare sawntimber for other value-added manufacture, such as

mouldings, builders joinery, furniture parts etc. In recent years, these downstream processing activities have increased substantially due to the emphasis of the government. Table 3 shows the export performance of the timber products associated with kiln dried timbers from 1990 to 2000. In fact, the kiln drying industry has played an important role in helping the furniture industry to achieve the RM 1 billion export target in 1994; two years earlier than the targeted deadline set by the government. It is anticipated that the furniture export revenue would reach RM 7 billion by 2005 (Anon, 1999a) and the kiln dry industry is expected to contribute significantly towards this development.

Table 3: Malaysia Export of Timber Products Related to Kiln Drying (Value in Million RM)

Year	Furniture	Moulding	Dressed Timber	Builders Carpentary & Joinery	Total
1990	215	488	n.a	n.a	703
1991	403	543	n.a	214	1,160
1992	579	713	n.a	254	1,546
1993	936	585	166	282	1,969
1994	1,413	633	168	333	2,547
1995	1,674	618	152	339	2,783
1996	2,089	672	131	403	3,295
1997	2,531	783	172	504	3,990
1998	3,246	745	179	662	4,832
1999	3,900	825	192	716	5,633
2000	4,419	895	219	768	6,301

Source: Maskayu (various issues)